

Asiatic brown fruit rot - *Monilia polystroma*

Monilia polystroma is the conidial form of an unknown apothecial ascomycete closely related to *Monilinia fructigena*, from which it has so far been distinguished by molecular means. Although *M. fructigena* and the other brown-rot species, *M. fructicola* and *M. laxa*, are known on various continents, *Monilia polystroma* was identified in Japan and initially known only in that country. A recent published report placed it in Hungary as well and there is unpublished data indicating that it occurs in China. This species may be widely distributed in Asia and perhaps Europe. In the absence of natural barriers, it may spread by means of airborne conidia. Long distance dispersal would most likely occur through infected planting stock or fruit. *Monilia polystroma* is a regulated pest for Canada while *Monilinia fructigena* is a regulated pest in the USA.

Monilia polystroma G.C.M. Leeuwen, Mycol. Pap. 106: 450. 2002.

Colonies on potato dextrose agar (PDA) growing to 50-60 mm diam after 6 days at 22°C under 12 h light/12 h dark cycle. Colony margin even, sporogenous tissue slightly elevated above the colony surface, 1-2 mm, buff/pale luteous. Stromatal initials forming 10-12 days after culture initiation; mature black stromatal plates at first discrete, later coalescing. Macroconidia globose, ovoid or limoniform, smooth, 12-21 × 8-12 µm, mean = 16.4 × 10.1 µm in distilled water when grown on cherry agar (CHA) at 22° under NUV; 11-20 × 8-11 µm, mean 14.9 × 9.1 µm, on pear fruit at 15°C. Thick hyphal layer of stroma on colonized fruit; conidial tufts buff to brownish-grey.

Additional details are found in van Leeuwen et al. (2002)

Distribution: Asia (China, Japan), Europe (Hungary).

Host: Causes as fruit rot on *Cydonia*, *Malus*, *Prunus*, *Pyrus* spp. (Rosaceae); survives on mummified fruit.

Notes: Descriptions of *Monilinia fructigena*, *M. laxa*, and *M. fructicola* should be compared in order to identify the most consistent morphological distinctions between their *Monilia* conidial forms and *M. polystroma*. An EPPO diagnostic protocol for *M. fructicola* (EPPO, 2003) includes a table of comparisons. The Japanese isolates identified as *Monilia polystroma* produced more stromata on cherry agar, had a significantly higher mean growth rate on PDA, and produced generally smaller conidia on both cherry agar and inoculated pear fruit than did isolates of *M. fructigena*. (Leeuwen et al., 2002)

The genus *Monilia* includes species that are the conidial anamorphs of *Monilinia*. *Monilinia* in the family Sclerotiniaceae (Helotiales, Ascomycota) is characterized by its conidial and stromatal anamorphs, apothecial ascomata, and ascospores (Byrde and Willets, 1977). Consequently, *Monilia polystroma* would be expected to have a *Monilinia* sexual state.

Three closely related fungi, *Monilinia fructicola*, *M. fructigena* and *M. laxa*, cause economically important diseases e.g., blossom and twig blights, brown fruit rot, of plants in fruit tree genera of the Rosaceae (e.g., *Malus*, *Prunus*, *Pyrus*). Some *Monilinia* species also attack ornamental flowering fruit trees.

Monilinia fructigena is primarily found in the Eastern Hemisphere, particularly in temperate Europe and Asia, and coexists in many areas with *M. laxa*. *Monilinia fructicola* and *M. laxa*, which produce similar disease symptoms and have common hosts, coexist in the Western Hemisphere, notably North America, and Australia. It is generally only in Central and Eastern Asia, where the host fruit trees originated, that all three species of *Monilinia* occur (Fulton et al., 1999).

Recent studies by Leeuwen et al. (2002) compared six isolates of *M. fructigena* collected in Japan on apple, *Malus pumila*, with the same number of isolates collected in Europe on *Malus* and *Prunus*. A general comparison of morphology revealed that there were significant differences between isolates from the two regions in colony characteristics, stroma formation, growth rate, and conidial dimensions. Differences between the two groups had previously been demonstrated using the ITS region of ribosomal DNA (Fulton et al., 1999). These studies suggested that the Japanese isolates were distinct enough from the European *M. fructigena* to be considered a separate species. Because no sexual form was observed, this species was named and described only in the asexual form as *Monilia polystroma*. It is likely that some Japanese specimens of the teleomorph, previously identified as *M. fructigena*, are the sexual form of the new species (Leeuwen et al., 2002) but currently none has been identified as such.

DISTRIBUTION

Monilina polystroma was first identified as a distinct species composed of Japanese isolates previously identified as *Monilinia fructigena* (Leeuwen et al., 2002). Petroczy and Palkovics (2009) have now

reported it in Hungary. A DNA sequence from a Chinese isolate has been attributed to this species (NCBI, 2010). Isolates of *Monilinia fructigena* from other areas of East Asia, including China, Korea and Russia, should be examined to determine whether some isolates belong to this newly described species (van Leeuwen et al., 2002).

RISK OF INTRODUCTION

The risk of introduction of this species is presumably similar to that of brown-rot species of *Monilinia*. Where these already occur, *Monilia polystroma* may be the equivalent of a new strain, which may have a differing host range or different levels of virulence on the same hosts. Where no brown rot pathogen is present in a new fruit-growing area, the introduction of any of the brown rot fungi is a significant threat to pome and stone fruit production. Where no natural barriers to tree-to-tree spread exist in Europe and Asia, the likelihood of introduction of *Monilia polystroma* depends on its yet undetermined current distribution. On other continents, the possibility depends largely on the quality of the regulatory barriers against importation of infected tree propagating material and fruit.

DIAGNOSTIC METHODS

Monilia polystroma cannot be distinguished with certainty from the other brown-rot fungi except by laboratory examination.

In the past, identification of the three more widespread brown-rot species, *Monilinia fructicola*, *M. fructigena* and *M. laxa*, has primarily been based on morphological and cultural growth characteristics on artificial media (Byrde and Willets, 1977). More recently the species have also been differentiated based on sequence divergence within the internal transcribed spacer (ITS) region of the ribosomal DNA (rDNA). In this regard, comparisons of a large number of *M. fructigena* isolates in Europe and Japan demonstrated that isolates from Japan had four base substitutions in ITS 1 and one substitution in the ITS 2 region, when compared to the European isolates (Fulton et al., 1999).

Another study comparing the sequences of random amplified polymorphic DNA fragments from *Monilinia fructigena* and *Monilia polystroma* confirmed the close relationship between the two species. However, RAPD patterns were also sufficiently different to allow the two species to be distinguished using a multiplex PCR technique (Côté et al., 2004). This technique identified species in infected fruit as well as from pure culture.

NOTES ON CROPS/OTHER PLANTS AFFECTED

The type description by van Leeuwen et al. (2002) dealt only with isolates from apple (*Malus pumila*), and a recent discovery of the species in Hungary (Petroczy and Palkovics, 2009) also was on apple as the host. Detailed studies on the potential host range of this species have not yet been conducted. However, according to previous work carried out on Japanese isolates then identified as *Monilinia fructigena* (Harada, 1998), the fungus has a host range similar to *M. fructigena* in Europe, and is found on species of *Cydonia*, *Malus*, *Prunus*, and *Pyrus*.

SYMPTOMS

Monilia polystroma causes the same or very similar symptoms to those reported for *Monilinia fructigena* and, therefore, is likely to be associated with blossom, twig and leaf blights, stem cankers and brown fruit rots (Byrde and Willets, 1977). For further information on symptoms, refer to the datasheet on *M. fructigena*.

BIOLOGY AND ECOLOGY

Life cycle: For background on the biology of a similar, more studied, species, refer to the datasheet on *Monilinia fructigena*. *Monilia polystroma* has so far only been observed as the conidium-producing anamorph. Like the *Monilinia* species that also have *Monilia* forms, it may persist over winter in mummified fruit and/or infected twigs and buds. Under favorable environmental conditions, the fungus will sporulate and conidia will be disseminated by wind to susceptible vegetative tissues and fruit. Secondary cycles of spread will occur as reported for other brown-rot pathogens. (Byrde and Willets, 1977).

Previous work indicated biological similarity between Japanese and European isolates of *M. fructigena*, so presumably this remains true for *Monilia polystroma* and *M. fructigena*. For example, the teleomorph of *M. fructigena* is rarely seen and therefore the teleomorph likely plays little or no role in the life-cycle of *M. polystroma* (van Leeuwen et al., 2002). It would presumably develop in spring from mummified fruit on or in the soil.

Limited studies made by van Leeuwen et al. (2002) indicate that *Monilia polystroma* appears to be almost identical to *Monilinia fructigena*. A comparison of lesion growth rate and sporulation on most of the inoculated pear and apple cultivars tested showed no significant differences between the two fungal species. However, some results indicate that *M. polystroma* may colonize fruits of some cultivars slightly

faster than *M. fructigena*. In addition, the authors suggest that the abundant stromata formed by *M. polystroma* may enhance its survival by inhibiting decomposition of infected fruits, thus increasing the amount of primary inoculum produced in the next season over the level usually found with *M. fructigena*.

MOVEMENT AND DISPERSAL

Natural dispersal: *Monilia* conidia are primarily airborne, but may also be carried in rain splash.

Vector transmission: Insects or birds may carry the conidia nonspecifically on their bodies, but no observations of such transfer are published.

Accidental introduction: As with *Monilinia* species (Byrde and Willets, 1977), *Monilia polystroma* will presumably be spread by transport of infected nursery stock plants and infected fruits.

Plant parts liable to carry the pest in trade/transport:

- Fruits (inc. pods): Spores, hyphae; borne internally; borne externally; visible to naked eye.
- Flowers/Inflorescences/Cones/Calyx: Spores, hyphae; borne internally; borne externally; visible to naked eye.
- Leaves: Spores, hyphae; borne internally; visible to naked eye.
- Stems (above Ground)/Shoots/Trunks/Branches: Spores, hyphae; borne internally; borne externally; visible to naked eye.

Plant parts not known to carry the pest in trade/transport:

- Bulbs/Tubers/Corms/Rhizomes
- Seedlings/Micropropagated Plants
- Roots
- True Seeds (inc. grain)

SEEDBORNE ASPECTS OF DISEASE

Because fruit are not usually propagated from seed, the likelihood that infected fruit may contain infected or infested seed will seldom be of relevance to spread of the brown-rot fungi.

IMPACTS

Impacts are presumed to be the same or very similar to those of *Monilinia fructigena*. See the datasheet on *M. fructigena* for details.

MANAGEMENT

SPS measures

Regulations about importation of fruit tree propagating material, such as those of Canada (CFIA, 2006), should prevent introduction of the pathogen across natural barriers to spread. The brown-rot fungi are Regulated Pests for the USA as well (Cline and Farr, 2006).

Control

Given the similarities to *Monilinia fructigena*, information on control of that pathogen is likely to apply to *Monilia polystroma*.

GAPS IN KNOWLEDGE/RESEARCH NEEDS:

The teleomorph for this species, whether it can be found fresh in nature or among Japanese specimens identified as *M. fructigena*, remains to be described.

The current distribution of *Monilia polystroma*, which is probably more widespread in Asia and has now been found in eastern Europe, is unknown. Likewise, the host range, though likely similar to that of the other brown-rot fungi, is undetermined. The virulence of *M. polystroma* on varieties grown in countries where it is present or those to which it is likely to spread due to the absence of natural barriers, is information important in establishing its possible impact and control.

References

